



GEO Innovation
LLC

Advancing Solar Excellence
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Solar Power 101 – PV (Photovoltaic) Basics

- ☀ Definitions
- ☀ Before Going Solar (Conservation)
- ☀ How PV Works
- ☀ Various PV Installations
- ☀ Steps to going Solar
- ☀ Q and A



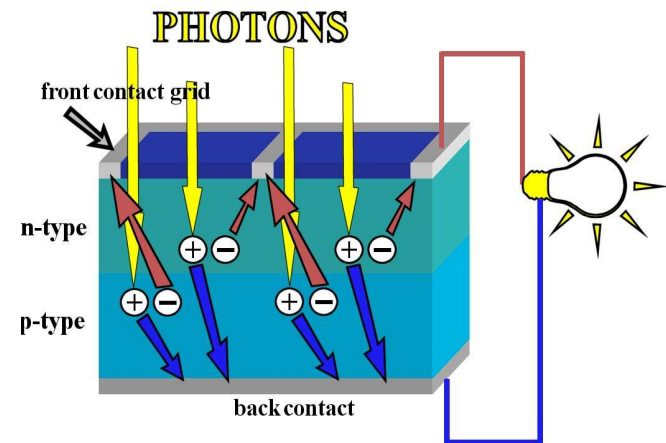
Definitions

Converting Sunlight to Solar Electricity



pho-to-vol-ta-ic (f¹/₂''t¹/₂-v¹/₄l-t³/₄k, -v¹/₂l-) *adj.* Capable of producing a voltage when exposed to radiant energy, especially light.

Sunlight (photons) push electrons around in something called a PN junction which is the building block of the computer industry. Once the electrons get pushed out of their resting place (holes) their only way to reunite as an electron-hole pair is to ride back through a light, motor, etc. and do useful work for us.





Definitions

Photovoltaics

What is Solar Electricity?

A solar electric cell captures the energy from sunlight and transforms it into electric current due to the **photovoltaic effect**.

The photovoltaic effect occurs when sunlight strikes certain semi-conductive materials such as silicon in a PV cell to produce electricity.

electric current

PV cell
A typical PV cell produces about 1-2 watts of power

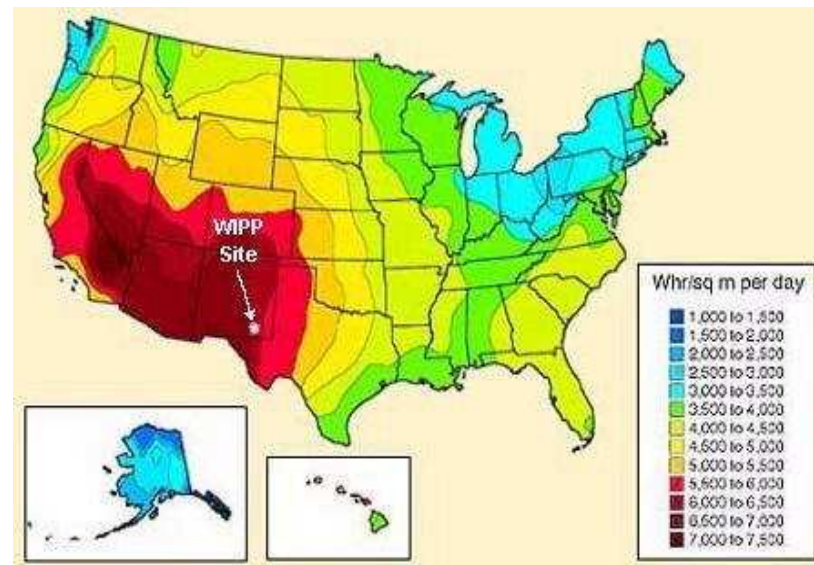
PV module
Cells can be linked together to create a PV module that produces more power

PV array
To meet larger demands, PV modules can be wired together to form a PV array.

photovoltaic
adj. fō-tō-vōl-tā-ik
photon = unit of light energy +
volt = measure of electrical potential

The power captured from the sunlight can be used to power all types of electrical appliances and tools.

Insolation

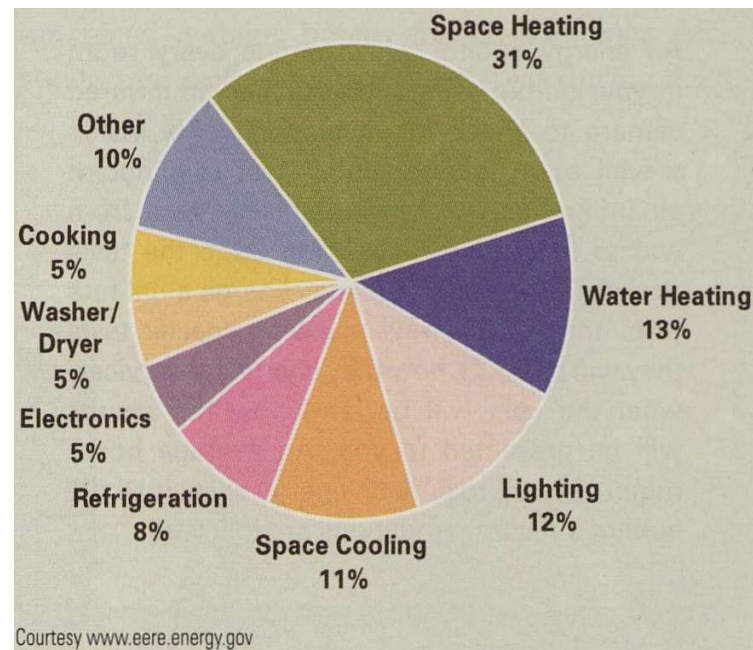


Before Going Solar (Conservation)

U.S. Energy Consumption

North America has 7 percent
of the world's population,
and consumes 30 percent of
the world's energy.

- Energy Ottawa





Before Going Solar (Conservation)

What is the Grid?



The North American Grid at Night.

The Grid is a power delivery network.

By comparison, the Internet is an information delivery network.

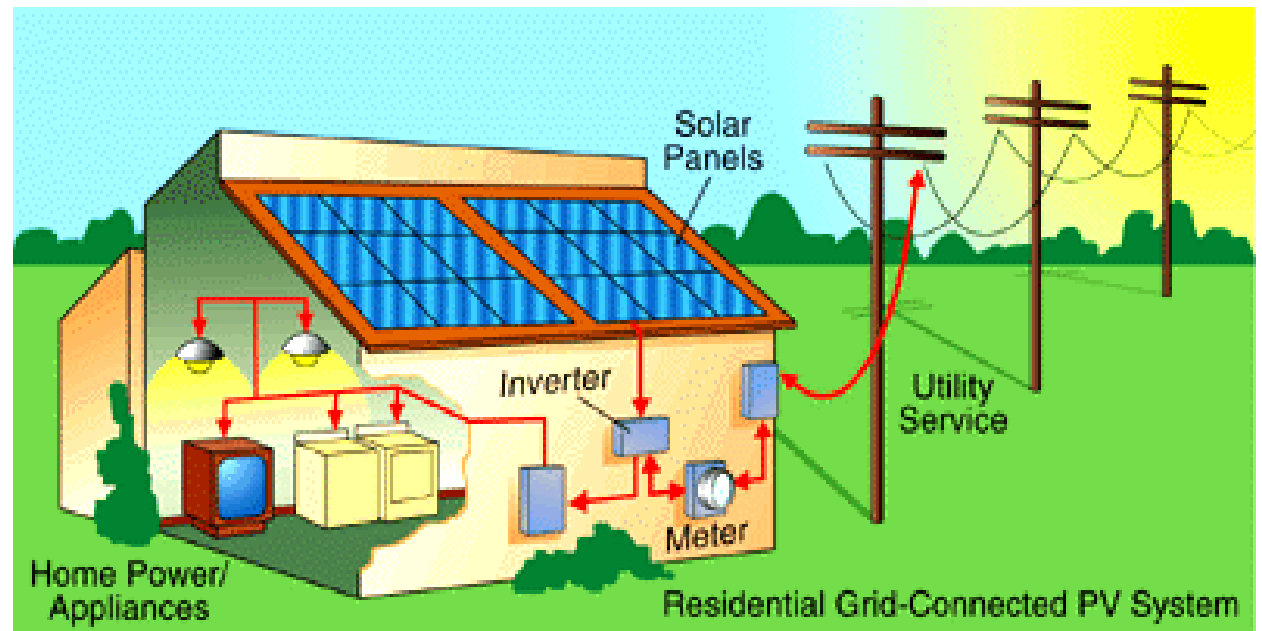


Before Going Solar Conservation

- ☀ Eliminate clothes dryer use
- ☀ Use compact fluorescent or LED bulbs
- ☀ Replace pre-1993 refrigerators, don't use in garage
- ☀ Buy front loading washing machine (when replacing)
- ☀ Use a hot water heater blanket
- ☀ Use power strips to control phantom loads
- ☀ Schedule car free days
- ☀ Add attic insulation
- ☀ Recycle
- ☀ Use a Kill-A-Watt meter to measure appliance loads. Available for under \$30.
- ☀ When replacing, buy at least SEER 14 AC/heat pump unit

How Grid-Tied PV Systems Work

- PV panels produce DC electricity which is then converted to AC house current using a Grid-Tied Inverter
- If the house can't use all the electricity the PV system produces, then the excess is put back on the grid for others to use.





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PV Installations



5.98KWDC Grid-Tied Home in Tucson

PV Installations



9.5KWDC Grid-Tied System
on Standing Seam Metal Roof

PV Installations



PV Installations

5.4KWDC Grid-Tied System Integrated into Greenhouse





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PV Installations



PV Installations



6.4KWDC Grid-Tied System in Vail

PV Installations



6.8KWDC Grid-Tied System in Sahuarita
Ground Mount



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PV Installations

3.2 KWDC Grid-Tied Pole Mount System in Pima County





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PV Installations



Solar Lighting for Trico Electric Cooperative Headquarters



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PV Installations



Solar Lighting for Trico Electric Cooperative Headquarters



Steps to Going Solar

Contact an installer to perform an on-site evaluation

- ☀ Determine historical energy use from electric bills
- ☀ Determine roof area available for photovoltaic panels
- ☀ Select location for photovoltaic panels, solar inverter, and production meter
- ☀ Discuss costs for various system sizes
- ☀ Discuss installation timing

Decide to Go Ahead with Photovoltaic Installation

- ☀ Submit application to electric utility
- ☀ Sign contract with electric utility
- ☀ Sign contract with licensed contractor



Steps to Going Solar

Contractor Installs System

- Generate design drawings and pull permit
- Install system on scheduled week
- County or City inspects system once installation is complete
- Utility Sends Rebate Check 6 to 8 Weeks after they inspect system

Enjoy decades of environmentally friendly and maintenance free electricity



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Example Pricing

5KW PV System @ \$5.50/watt

Total Cost \$27,500

TEP Rebate \$15,000

Total Cash Outlay \$12,500

State Tax Credit \$1,000

Federal Tax Credit \$3,750

Net Project Cost \$7,750



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Q and A